Cruise: Equinox_0315
Ship: Equinox
Expo Code: EQNX20150306
Dates: March 6th – March 11th, 2015
Chief Scientist: Dr. Denis Pierrot
Equipment: TSG-Flow thru system
Total number of stations: 19
Location: Ft. Lauderdale, FL and the US, Virgin Islands

Sample Collection

The discrete samples were collected from the TSG-flow thru system onboard the ship of opportunity Royal Caribbean Equinox by Dr. Denis Pierrot. The date and time listed in the data file are UTC when each sample bottle was collected.

DIC:
19 locations, 19 samples each 500-ml, 6 duplicate samples.
Sample_ID#: 301, etc.; Sample bottle number
PI: Dr. Rik Wanninkhof
Analyzed by: Charles Featherstone

pH:
19 locations, 19 samples each 500-ml, 6 duplicate samples.
Sample_ID#: 301, etc.; Sample bottle number
PI: Dr. Rik Wanninkhof
Analyzed by: Charles Featherstone

TAlk:
19 locations, 19 samples each 500-ml, 6 duplicate samples.
Sample_ID#: 301, etc.; Sample bottle number
PI: Dr. Rik Wanninkhof
Analyzed by: Dr. Leticia Barbero and Charles Featherstone

Sample Analysis

DIC:

Instrument ID	Date	Certified CRM (µmol/kg)	CRM Value (µmol/kg)	CRM Offset (µmol/kg)	Blank (Counts)	Avg. Sample Analysis Time
AOML 3	03/24/2015	2016.65	2017.60	0.95	15.2	13

Analysis date: 03/24/2015
Coulometer used: DICE–CM5015- AOML 3
Blanks: 15.2 counts/min

CRM # 0793 was used and with an assigned value of (includes both DIC and salinity):
Batch 129, c: 2016.65 µmol/kg, S: 33.361
CRM values measured: AOML 3: offset 0.95 µmol/kg (2017.60 µmol/kg).
Average run time, minimum run time, maximum run time: 13, 8 and 20 min.

Reproducibility: (# samples and average difference): 6 sets of duplicate samples, average difference 6.01 µmol/kg (0.65-12.21), average STDEV of 4.25 (0.46-8.63).

Instrument ID	Sample ID	Bottle #	Corrected DIC (µmol/kg)	Average	Difference	STDEV
AOML3	1	1	2047.81			
AOML3	2	2	2045.96	2046.89	1.85	1.31
AOML3	6	6	2069.12			
AOML3	7	7	2074.75	2071.93	5.63	3.98
AOML3	12	12	2052.74			
AOML3	13	13	2040.54	2046.64	12.21	8.63
AOML3	14	14	2046.04			
AOML3	15	15	2037.81	2041.93	8.23	5.82
AOML3	16	16	2025.35			
AOML3	17	17	2032.85	2029.10	7.51	5.31
AOML3	18	18	2030.73			
AOML3	19	19	2030.08	2030.40	0.65	0.46
Average					6.01	4.25

CRM, salinity and HgCl2 correction applied: Salinity correction was applied using TSG salinity.

Remarks

The volume correction was applied due to added $HgCl_2$ (Measured DIC*1.00037).
The first CRM of each cell was used for a CRM correction.

The DIC instruments were stable: the gas loop and CRM values did not change significantly throughout the life span of each cell. End blank (AOML 3 =27.5).

The samples were analyzed using the DICE (AOML 3) and a new coulometer from UIC, Inc. CM5015 with CM5011 emulation software.

Duplicates were sampled 1 to 3 minutes apart from the ships TSG flow thru system.

pH:

Analysis date: 03/24/2015
Spectrophotometer used: HP Agilent 8453

Reproducibility: (# samples and average difference): 6 sets of duplicate samples, average difference 0.089 (0.0016-0.0193), average STDEV of 0.0063 (0.0012-0.0137).

System	Bottle #	Sample ID	pH	Average	Difference	STDEV
HP Agilent 8453	1	1	8.0903			
HP Agilent 8453	2	2	8.1004	8.0953	0.0101	0.0072
HP Agilent 8453	6	6	8.1279			
HP Agilent 8453	7	7	8.1134	8.1206	0.0146	0.0103
HP Agilent 8453	12	12	8.1084			
HP Agilent 8453	13	13	8.1127	8.1106	0.0044	0.0031
HP Agilent 8453	14	14	8.1131			
HP Agilent 8453	15	15	8.1147	8.1139	0.0016	0.0012
HP Agilent 8453	16	16	8.1092			
HP Agilent 8453	17	17	8.1059	8.1075	0.0032	0.0023
HP Agilent 8453	18	18	8.1094			
HP Agilent 8453	19	19	8.1288	8.1191	0.0193	0.0137
Average					0.0089	0.0063

Remarks

The equations of Liu et al, 2011 formulated using the purified m-cresol purple indicator was used to determine pH of the samples. pH samples were analyzed at 20^0C at Full Scale (pH 0-14).

Temperature for each sample was measured before analysis using a Hart Scientific Fluke 1523 reference thermometer.

Approximately 80 mL of sample was extracted from each DIC sample bottle by syringe before DIC analysis to determine the pH.

Duplicates were sampled 1 to 3 minutes apart from the ships TSG flow thru system.

TAlk:

The results posted are analyses from the same sample bottles used for DIC and pH.
Analysis dates: 03/25/2015
Titration system used: Open cell
CRM batch: 129, S = 33.361, certified TA = 2237.32 µmol/kg

2 CRM samples were run on each cell, before and after the seawater samples. The TA for the water samples was corrected using the averaged ratios between the certified and measured values of the 2 CRMs run on each cell. The following table shows the CRM measurements for each cell.

Cell System	Date	Time	Bottle #	TA	|ΔCRM|
1	3/25/2015	11:58:09	201	2219.28	
1	3/25/2015	16:38:22	795	2222.28	3.00
2	3/25/2015	12:08:25	201	2211.12	
2	3/25/2015	16:38:54	795	2214.66	3.54
				Average	3.27
				Std. Dev.	0.38

Reproducibility: 5 sets of duplicate samples were run in the cell 1 and one set of duplicates was run on cell 2, with an average absolute difference of 1.68 µmol/kg (0.03 – 2.96), and a Standard Deviation of 1.06. The duplicates were sampled 1 to 3 minutes apart from the ships TSG flow thru system.

Bottle #	System	Date	Time	S	TA	|Difference|	Comments
1	2	3/25/2015	12:39:09	36.38	2378.04	1.67	
2	2	3/25/2015	13:01:10	36.36	2379.71		
6	1	3/25/2015	12:16:44	36.66	2398.27	0.03	
7	1	3/25/2015	12:40:53	36.66	2398.30		
12	1	3/25/2015	13:03:00	36.14	2369.52	2.96	
13	1	3/25/2015	13:25:40	36.17	2372.48		
14	1	3/25/2015	13:52:44	36.13	2370.84	2.70	
15	1	3/25/2015	14:17:48	36.16	2373.54		
16	1	3/25/2015	14:41:17	35.88	2354.90	1.48	

17	1	3/25/2015	15:04:36	35.88	2356.38	
18	1	3/25/2015	15:26:18	35.89	2355.31	1.26
19	1	3/25/2015	15:55:31	35.88	2356.57	
					Average	1.68
					Std. Dev.	1.06

Remarks

The two systems behaved well during the analyses.

Duplicates were sampled from the ships TSG flow thru system 1 to 3 minutes apart.

Comments

The latitude, longitude, date, and time reported with the DIC, pH and TAlk measurements were taken from the sample field log. The field log values are provided for reference; no post-cruise assurance of accuracy has been done to this data.

The Sample ID is the sample station, cast number and Niskin bottle number for the discrete samples.